Integrating Insect Pest Management

and

Crawfish Production

Michael Stout
Ray McClain
Department of Entomology
Rice Research Station

Acknowledgments

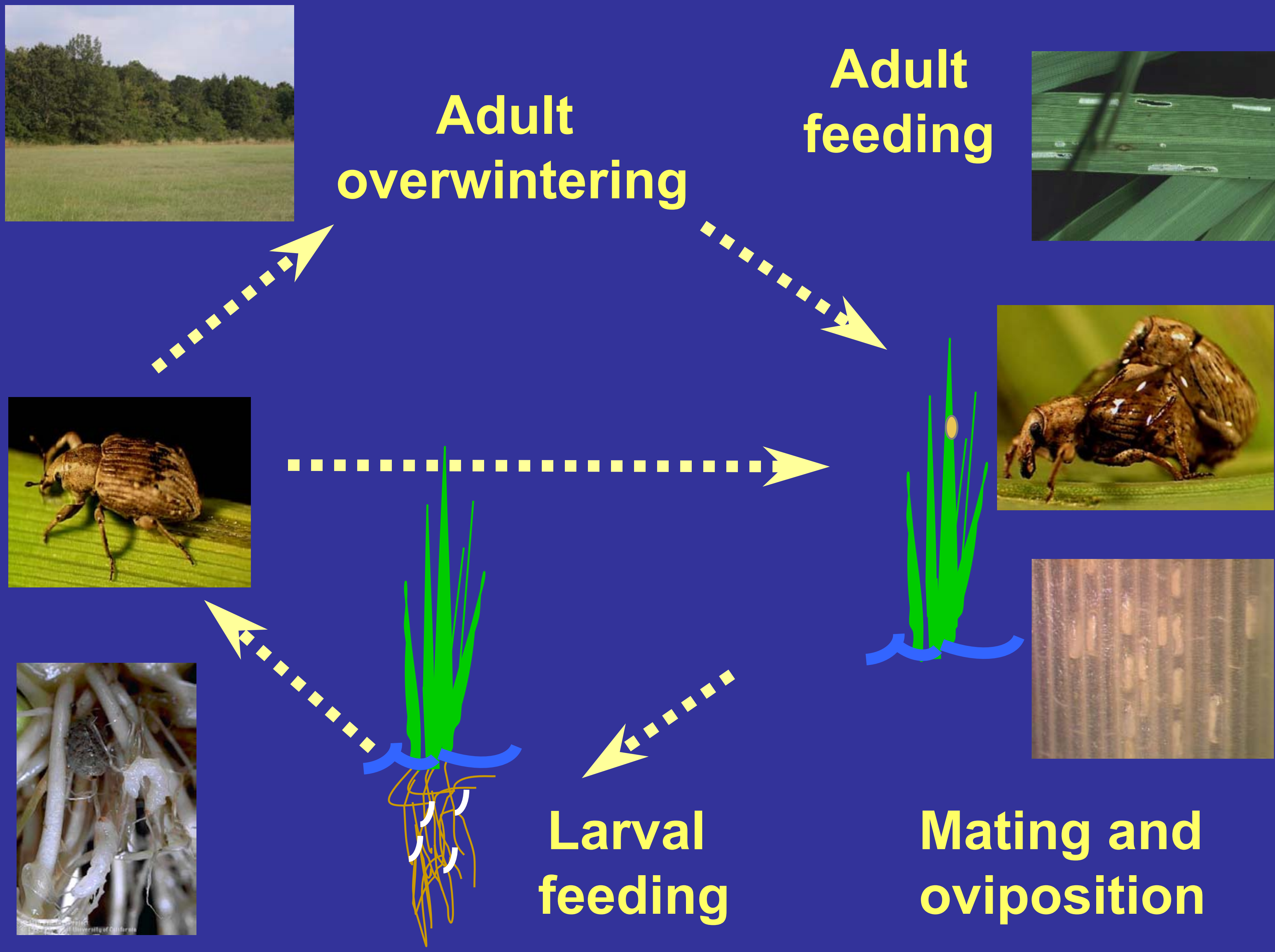
Collaborators
Ray McClain, LSU RRS
Gary Barbee, Agronomy

Graduate Students
Srinivas Lanka

Research Associates
Rita Riggio
Marty Frey
Ryan Pousson

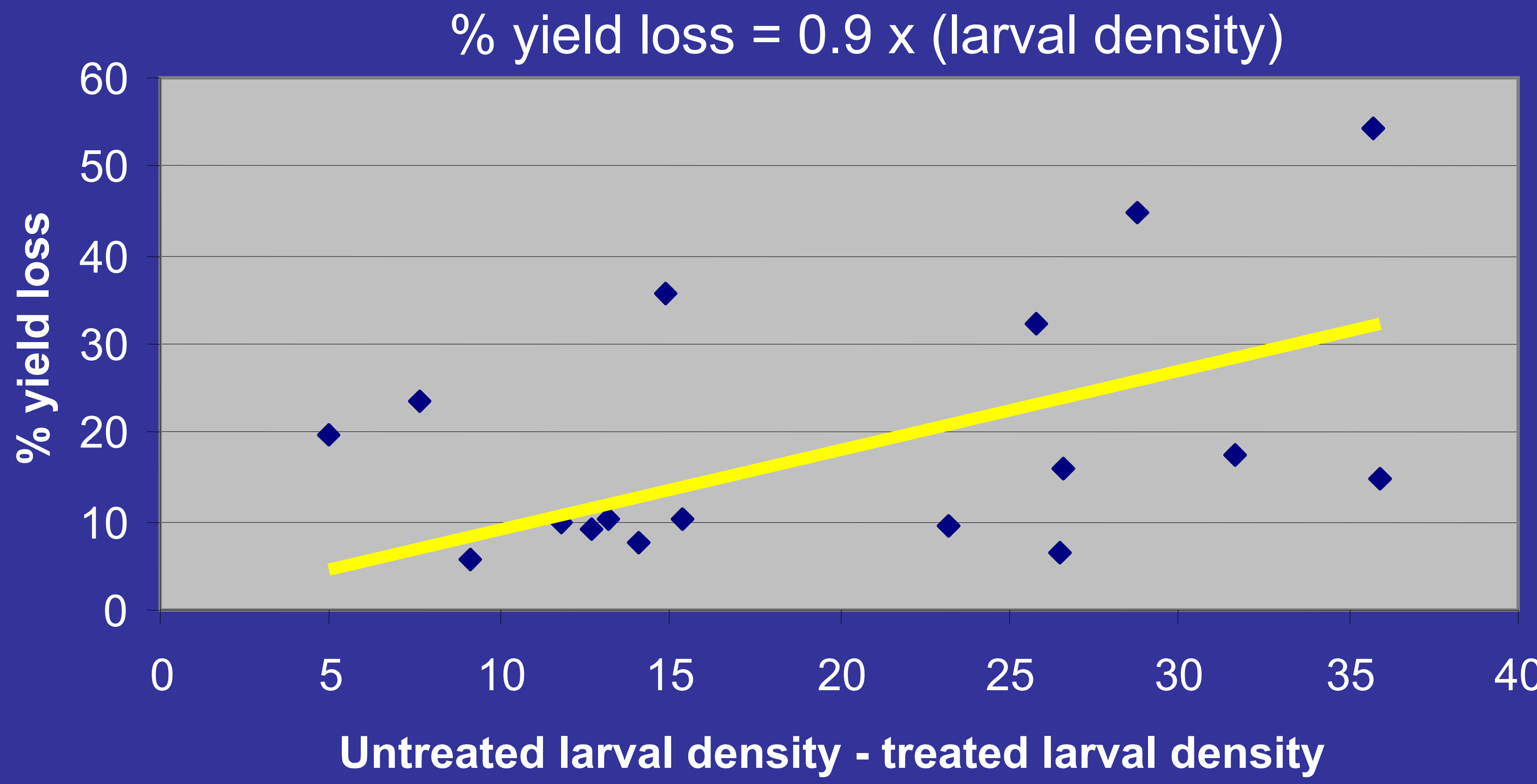
LSU AgCenter Research & Extension

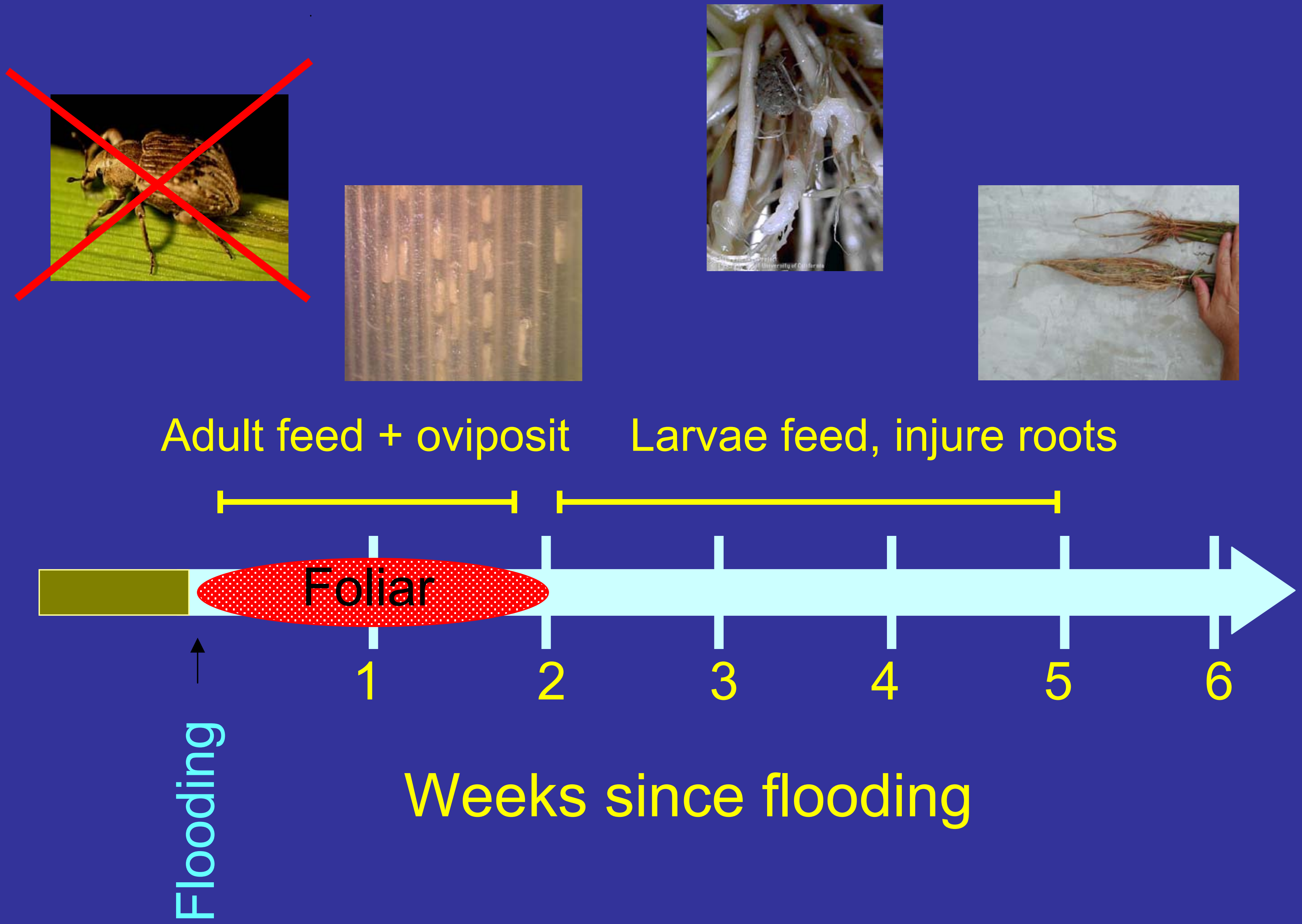
Funding
La. Rice Research Board
USDA, Pest Management Alternatives Program


Adult
overwintering
Adult
feeding
Mating and
oviposition
Larval
feeding

Weevil larval density vs. yield loss

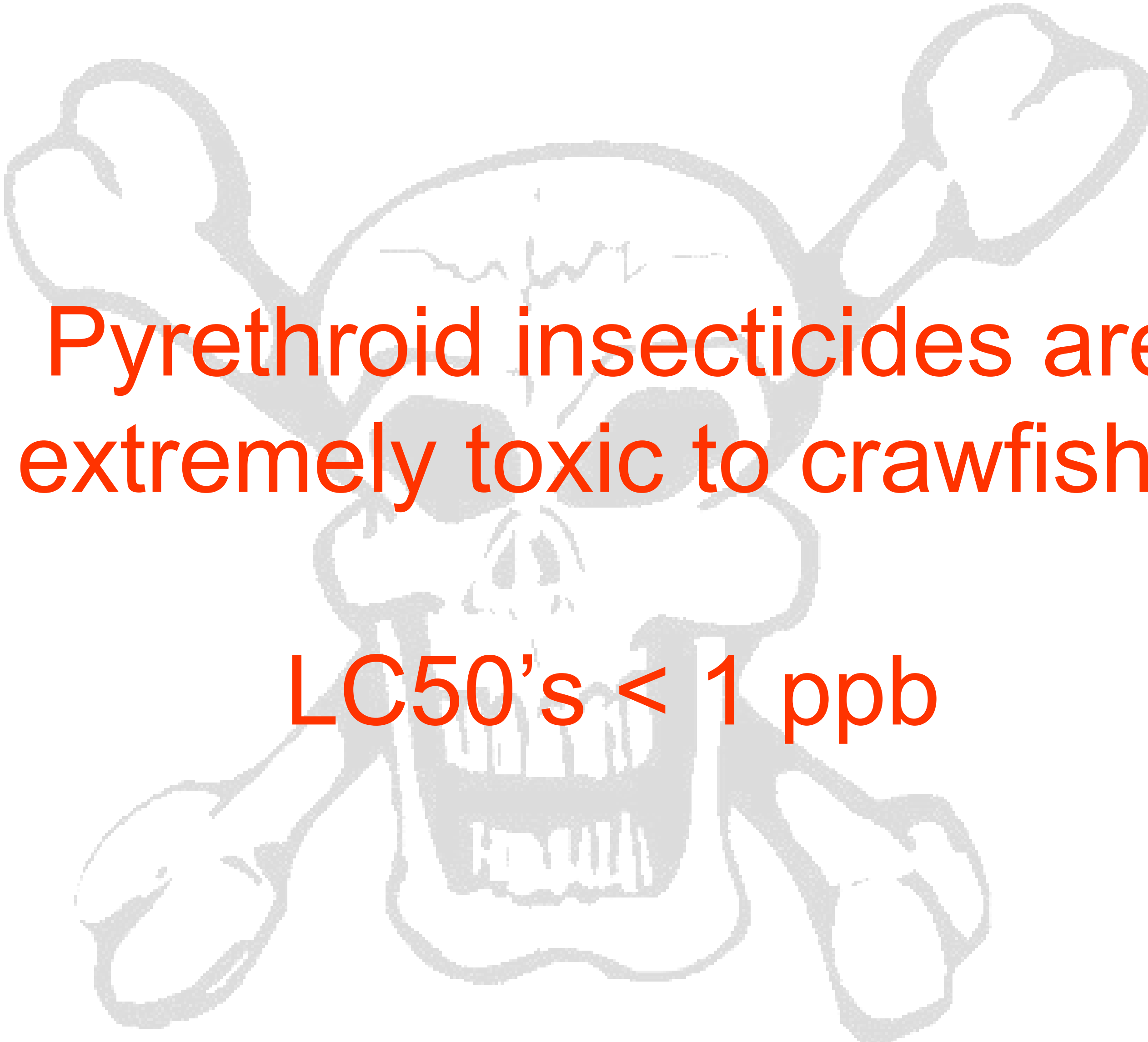
Calculated from insecticide evaluations, 2002-2007




Adult feed + oviposit
Larvae feed, injure roots
Foliar
1
2
3
4
5
6
Flooding
Weeks since flooding

Issues surrounding use of insecticides (pyrethroids)

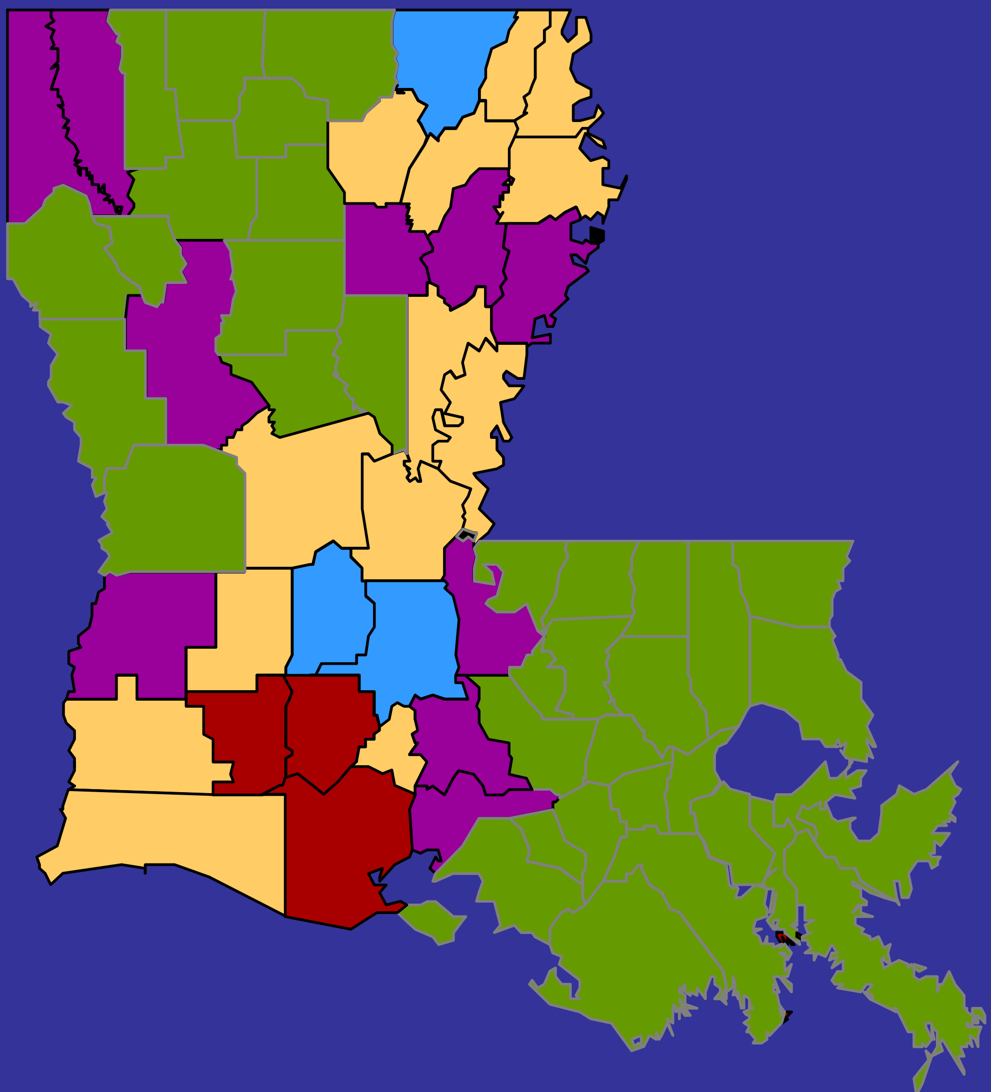
- Cost
- Inadequate control
- Environmental damage
- Incompatibility with crawfish production



Pyrethroid insecticides are extremely toxic to crawfish!!

LC50's < 1 ppb

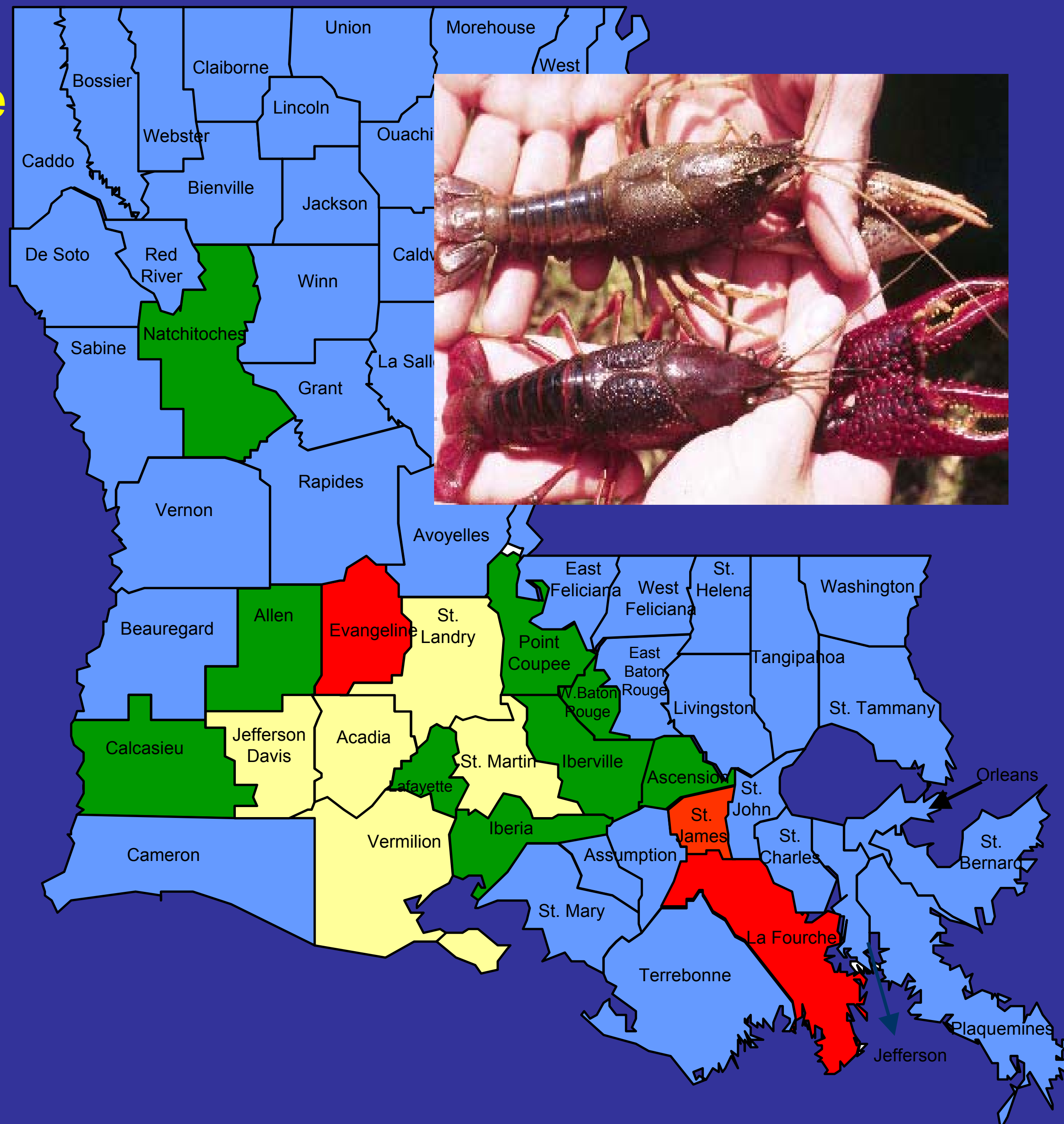
2005 Rice Acreage by Parish



- >60,000
- 20,000-59,999
- 5,000-19,999
- 1-4,999
- 0

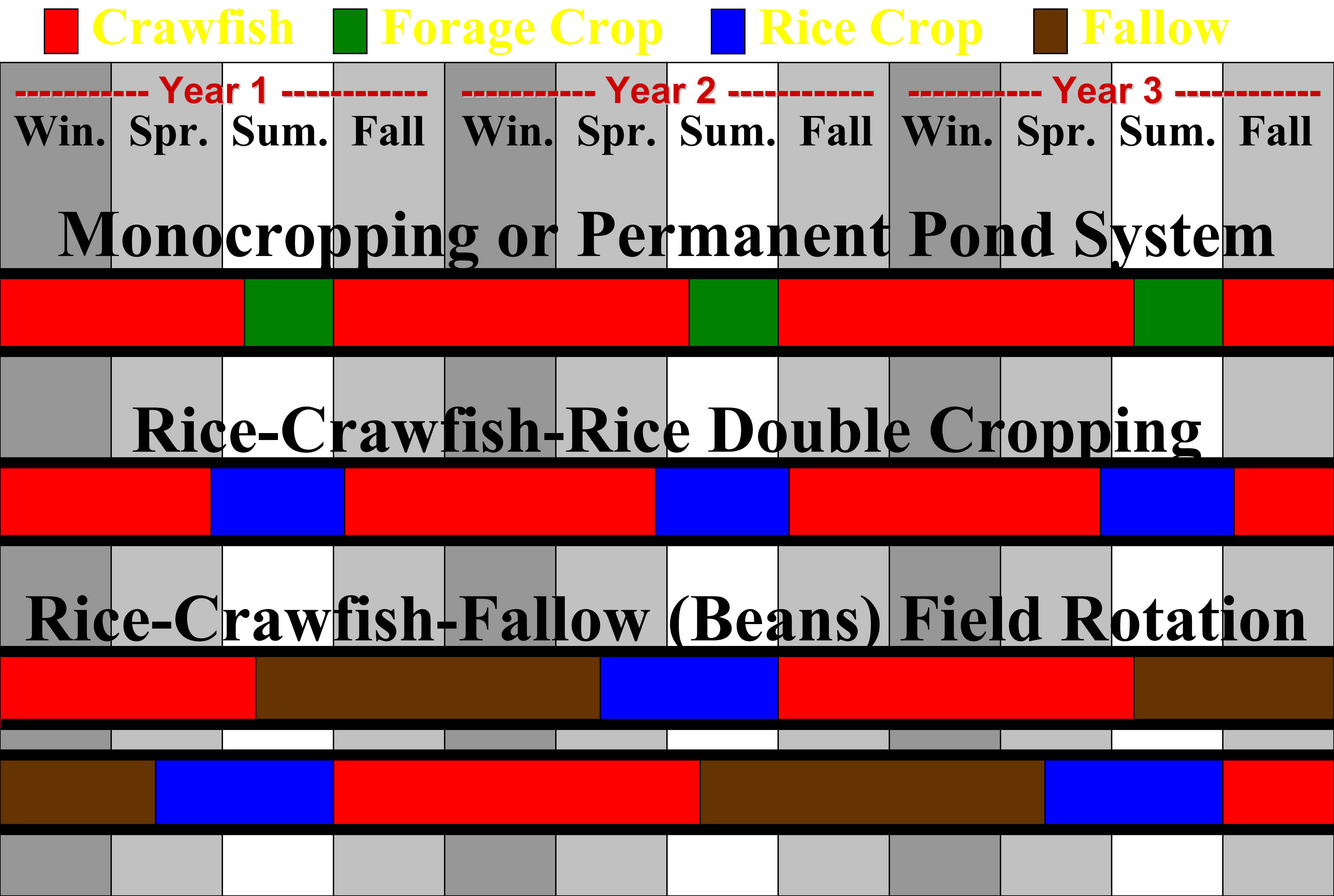
Total 525,353

2004
Crawfish Acreage
Total – 118,250



- 10,000 – >
- 5,000 – 9,999
- 1,000 – 4,999
- < 1,000

Source: Louisiana Ag Summary 2004


Crawfish
Forage Crop
Rice Crop
Fallow
----------- Year 1 ------------
----------- Year 2 ------------
----------- Year 3 ------------
Win. Spr. Sum. Fall Win. Spr. Sum. Fall Win. Spr. Sum. Fall
Monocropping or Permanent Pond System
Rice-Crawfish-Rice Double Cropping
Rice-Crawfish-Fallow (Beans) Field Rotation

Routes of exposure

- Drift of insecticide from rice field into neighboring pond
- Mortality of indigenous crawfish population in rice field
- Mortality of brood stock
- Release of contaminated water into pond

How can impact of weevil management on crawfish production be minimized?

- Use toxic insecticides in a way that minimizes their impact
- Use insecticides less toxic to crawfish
- Increase reliance on alternative strategies

Use toxic insecticides in a way that minimizes their impact

Use formulations less prone to drift:

a) Trebon (granular pyrethroid)

b) Pyrethroids coated/impreganted on fertilizer

Fertilizer impregnation test, 2005

LSU RRS, small plots, drill-seeded on 5 April
Urea coated manually

1) Untreated control
2) Karate, 0.04 lb ai/A, 1 day pre-flood
3) Karate, 0.04 lb ai/A, 2 days post-flood
4) Karate, 0.04 lb ai/A, 6 days post-flood
5) Karate, 0.04 lb ai/A, 20 days post-flood
6) Mustang Max, 0.025 lb ai/A, 2 days post-flood

Treatment	Larvae per core sample ± s.e. on:		
	5/26/05 (22 dpf)	**6/2/05 (29 dpf)**	**6/8/05 (35 dpf)**
Untreated control	9.2 ± 1.1	18.1 ± 2.3	19.6 ± 2.4
Karate pre-flood	2.1 ± 0.4	2.7 ± 0.4	5.9 ± 0.6
Karate 2 d post-flood	3.1 ± 0.4	4.8 ± 1.4	8.8 ± 1.3
Karate 6 d post-flood	3.9 ± 0.3	8.2 ± 1.3	7.9 ± 1.4
Karate 20 d post-flood	5.8 ± 1.0	8.2 ± 0.3	12.8 ± 2.3
Mustang Max 2 d post	2.3 ± 1.0	6.4 ± 1.0	6.8 ± 1.4

Treatment	Larvae per core sample ± s.e. on:		
	5/26/05 (22 dpf)	**6/2/05 (29 dpf)**	**6/8/05 (35 dpf)**
Untreated control	9.2 ± 1.1	18.1 ± 2.3	19.6 ± 2.4
Karate pre-flood	2.1 ± 0.4	2.7 ± 0.4	5.9 ± 0.6
Karate 2 d post-flood	3.1 ± 0.4	4.8 ± 1.4	8.8 ± 1.3
Karate 6 d post-flood	3.9 ± 0.3	8.2 ± 1.3	7.9 ± 1.4
Karate 20 d post-flood	5.8 ± 1.0	8.2 ± 0.3	12.8 ± 2.3
Mustang Max 2 d post	2.3 ± 1.0	6.4 ± 1.0	6.8 ± 1.4

Treatment	Larvae per core sample ± s.e. on:		
	5/26/05 (22 dpf)	**6/2/05 (29 dpf)**	**6/8/05 (35 dpf)**
Untreated control	9.2 ± 1.1	18.1 ± 2.3	19.6 ± 2.4
Karate pre-flood	2.1 ± 0.4	2.7 ± 0.4	5.9 ± 0.6
Karate 2 d post-flood	3.1 ± 0.4	4.8 ± 1.4	8.8 ± 1.3
Karate 6 d post-flood	3.9 ± 0.3	8.2 ± 1.3	7.9 ± 1.4
Karate 20 d post-flood	5.8 ± 1.0	8.2 ± 0.3	12.8 ± 2.3
Mustang Max 2 d post	2.3 ± 1.0	6.4 ± 1.0	6.8 ± 1.4

Fertilizer impregnation tests

Summary of results, 2004-2005

- **Pre-flood** and **early** post-flood applications of fertilizer-impregnated pyrethroids appear to work as well as foliar applications
- **Late** post-flood applications have lower efficacy than early post-flood applications. There may be some larvicidal activity, but this use pattern is not recommended
- Efficacy of pyrethroids in sufficient in fields with heavy infestations
- Problems with this approach

Use insecticides less toxic to crawfish

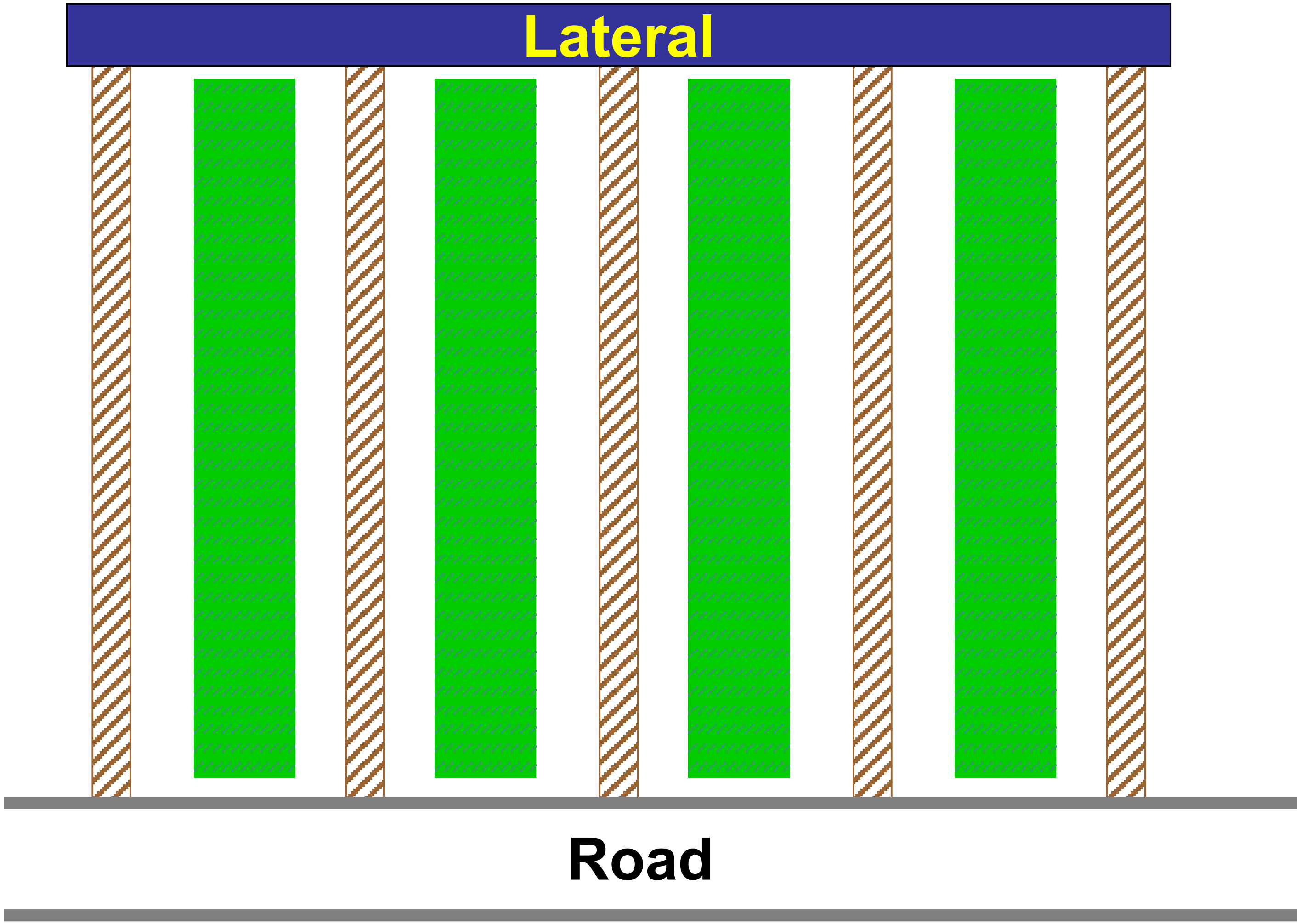
A number of new insecticides are now being seriously considered for the rice market, and these insecticides appear to be more compatible with crawfish production

Potential "pyrethroid alternatives" in rice

Insecticide	Class	Formulation/Use Pattern
Rynaxypyr (Dermacor)	Anthranilic diamide	Seed treatment
Clothianidin	Neonicotinoid	Seed treatment
Thiomethoxam	Neonicotinoid	Seed treatment
Dinotefuran	Neonicotinoid	Granular – pre- or post-flood

Crawfish/insecticide tests
Summary of experiments

In a series of preliminary field experiments, caged crawfish exposed to dinotefuran, clothianidin, and Rynaxypyr have experienced mortality rates similar to, or only slightly higher than, crawfish in control plots



1. Untreated seeds
2. Icon-treated seeds (0.05 lb ai/A)
3. Dermacor-treated seeds (0.2 mg ai/seed)
4. Dinotefuran pre-flood foliar (240 gm ai/A)

Table 1. Mortality of red swamp crawfish placed in enclosures at first flush in simulated rice plots treated with various rice insecticides. Mortality, number and percentage dead, was assessed at 2 days after stocking.

Days After Stocking	Min - Max Temp. °C	Untreated Control	Icon	Rynaxypyr
2	19 - 31	0	2 (20%)[1]	2 (20%)[2]

[1] Dead = 1 immature and 1 mature; and 3 (30%) additional crawfish were moribund.
[2] Dead = 2 mature.

Table 2. Mortality of red swamp crawfish placed in enclosures after permanent flood in simulated rice plots treated with various rice insecticides. Mortality, number and percentage dead, was assessed at 2, 5, and 7 days after stocking, and results are cumulative.

Days After Stocking	Min - Max Temp. °C	Untreated Control	Icon	Rynaxypyr	Dinotefuran[7]
2	17 - 32	3 (25%)[1]	2 (17%)[2]	3 (25%)[3]	0
5	15 - 35	5 (42%)[4]	3 (25%)[5]	3 (25%)[3]	0
7	19 - 30	5 (42%)[4]	4 (33.3)[6]	4 (33.3)[6]	0

[1] Dead = 1 immature and 2 mature.
[2] Dead = 2 mature.
[3] Dead = 3 immature.
[4] Dead = 2 immature and 3 mature.
[5] Dead = 3 mature; and 1 additional crawfish (8%) was moribund.
[6] Dead = 3 immature and 1 mature.
[7] Assessments for crawfish in Dinotefuran treatment were actually 1, 4, and 6 days after stocking, respectively.

Rynaxypyr seed consumption trial

	Days From Initiation of Trial								
	1	**3**	**7**	**9**	**18**	**21**	**28**	**30**	**37**
Control (Rep 1)	0	0	0	0	0	0	0	0	0
Control (Rep 2)	0	0	0	0	0	0	0	0	0
Control (%)							**0**		**0**
Low (Rep 1)	0	0	0	1	1	0	0	0	0
Low (Rep 2)	0	0	0	0	0	0	0	0	0
Low (%)							**16.7**		**16.7**
High (Rep 1)	0	0	0	0	0	0	0	1	0
High (Rep 2)	0	0	0	0	0	0	0	0	0
High (%)							**0**		**8.3**

Crawfish/insecticide tests
Further testing, 2008-2009

- Field trials with caged crawfish in treated plots
- Laboratory, acute toxicity experiments

Increase reliance on cultural practices

- Draining
- Early planting
- Delayed flooding
- Shallow flooding

Summary

- Use of granular “formulations” of pyrethroids reduces drift into neighboring ponds, but there are problems associated with the use of these formulations
  - --efficacy
  - --timing of fertilizer vs. insecticide
  - --worker safety
- New insecticides may soon be available that are more compatible with crawfish production
- Cultural practices can reduce amount of insecticide needed to control weevils